Challenger's officers[1] at Valparaiso and Monte Video, compared with those made by preceding observers, show that within half a century the whole force had respectively diminished one-sixth and one-seventh—at the Falkland Islands one-ninth. Farther north we find at Bahia and Ascension Island, in the same period of time, an equally marked diminution of one-ninth of the force. This area of *diminishing* force has wide limits; it would appear to reach the equator and to aproach Tahiti on the west and St. Helena on the east; at the Cape of Good Hope there is evidence of the force *increasing*.

"Such are the facts, and how are we to interpret them? Whichever way we look at the subject of the earth's magnetism and its secular changes, we find marvellous complexity and mystery; lapse of time and increase of knowledge appear to have thrown us farther and farther back in the solution. The terella of Halley, the revolving poles of Hansteen, and the more recent hypotheses of the ablest men of the day, all fail to solve the mystery. We must not, however, be discouraged at these repulses in the great conflict for the advancement of human knowledge. The present century has been productive of keen explorers in the field of terrestrial magnetism; others emulous of fame are pressing rapidly from the rear, and knowing as we do that knowledge shall be increased, we may confidently anticipate the day when this, one of Nature's most formidable secrets, shall be revealed."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

At the annual meeting of the Convocation of the University of London on May 14, a report from the annual committee was presented which recommended closer union and co-operation of the colleges and medical schools affiliated to the University with each other and with the Senate, and also more direct participation by the University in the work of higher education and in the encouragement of mature original work. The following resolutions were carried by large majorities after an animated debate, in which Drs. Odling, Payne, Baxter, Pye-Smith, and Weymouth, and Messrs. Hutton, Carey Foster, R. N. Fowler, and Fitch, took part:—1. That while Convocation recognises the advantages of examinations conducted by a body independent of the teachers of the candidates for degrees, it is expedient that the course of study pursued in those institutions should be brought into closer connection with the Senate. 2. That with this object it is desirable for the Senate to exercise its power under the present Charter of revising the list of affiliated Colleges, and from time to time of admitting to or excluding from this list according to the position taken by these Colleges at the University examinations for degrees, and on such other grounds as the Senate may in each case determine. 3. That it would be desirable that the educating bodies included in the revised list should be invited to communicate, by delegates or in writing, with the Senate, and that facilities should be afforded to such delegates of deliberating together and of communicating with the Senate, especially on the subject of examinations. 4. That it is desirable for the examiners of the University, either in faculties or collectively, to form a Board, one of whose functions would be to consider and report upon any subject connected with the examinations which they might deem of importance to the University. 5. That it is desirable that the University should take advantage of such opportunities as may present themselves of promoting, by the institution of University chairs, or otherwise, the cultivation of such higher or less usual branches of study as can be more conveniently or more efficiently taught by a central body. 6. That it is desirable for the Senate to consider the importance of recognising independent research in the examinations for the higher degrees in such way as the senate may approve.

M. Bardoux has sent to the French Chamber of Deputies a project for establishing in Algiers *écoles préparatoires* of science, letters, and law, in order to organise in the colony superior teaching. The expenses are estimated at one-and-a-half million of francs. An *école préparatoire* of medicine was established eighteen years ago.

The late Prof. Wilhelm Pütz, well known through his excellent geographical and historical hand-books, has bequeathed the sum of 115,000 reichsmark (5,750*l*.) to the University of Bonn, with the stipulation that it is to be employed for furthering the eaching of geography and history.

[1] This extended and carefully made series are prepared for publication; we cannot too highly estimate this valuable contribution to magnetical science.

SCIENTIFIC SERIALS

American Journal of Science and Arts, April.—In this number Prof. Hastings records observations which prove that the variation in dispersive power of glass, attending variation in temperature, is relatively enormously greater than that in the refractive power. This could hardly have before escaped notice, but for a singular relation in the co-efficients, in virtue of which, probably, an achromatic combination for one temperature is good for all others within moderate limits.—Prof. Rowland has made a new determination of the absolute unit of electrical resistance, his method being to induce a current in a closed circuit by reversal of the main current. He finds the B.A. unit too great by about ·88 per cent. A difference of nearly 3 per cent. between his result and that of Kohlrausch he endeavours to explain from a criticism of the latter's method, pointing out what he thinks its defects.—Prof. Langley differs from M. Janssen as to the ultimate form of the "grains" in the solar photosphere, regarding them as the ends of filaments (a simile he employs is that of a bird's-eye view of a field of grain acted on by wind), whilst M. Janssen thinks them literal spheres.—In the projection of microscope photographs, Prof. Draper increases the brilliancy of the result by removing the supporting stage of the slide further from the condenser so that a convergent beam of light may fall on the object.—Several papers in this number deal with points in American geology and physiography; the surface geology of South-West Pennsylvania, the driftless interior of North America, the ancient outlet of the Great Salt Lake, Lower Silurian fossils in Pennsylvanian limestone, intrusive nature of the triassic trap-sheets of New Jersey, &c. A tree-like fossil plant, *Glyptodendron*, lately found in the Upper Silurian rocks of Ohio is described by Prof. Claypole as (from its position) possessing a peculiar interest.

Annalen der Physik und Chemie, No. 3, 1878.—M. Röntgen here describes experiments which seem to invalidate results obtained by Wilhelmy in 1863 and 1864 regarding the condensation of fluids on the surface of solid bodies. He finds the difference of the two surface tensions, caoutchouc-air and caoutchouc-water, to be about 8·0 mg. per millimetre, when both have attained their normal value (which does not occur immediately after contact).—It is shown by M. Claes that for extremely dilute solutions of a substance with absorption-bands, the position of these bands may considerably vary, and a band is absolutely characterised by that wave-length which belongs to it in solution in solvents that are without dispersion.—In a paper on quantitative spectrum analysis, M. Vierordt investigates the influence of narrowing of the entrance-slit on colour-tone and brightness; by adapting four movable plates to the slit he has been able accurately to fix the amount of error in his determinations of intensity of light with his spectral photometer, and show that throughout the spectrum they are very small, and may mostly be neglected. In every case, however, they can be fully corrected by arrangements he describes.—M. Lommel advances a theory of normal and anomalous dispersion, and M. Fröhlich applies the principle of conservation of energy to the phenomena of diffraction.—The temperature-surface of water vapour is treated by M. Ritter.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, April 4.—"On the Determination of the Constants of the Cup Anemometer by Experiments with a Whirling Machine," by T. R. Robinson, D.D., F.R.S.

In his description of the cup anemometer (*Trans.* R. I. Academy, vol. xxii.), Dr. Robinson had inferred from experiments on a very limited scale with Robins whirling machine that the limiting ratio of the wind's velocity to that of the centres of the cups = 3. Recent experiments by M. Dohrandt have shown that this number is too great. As some of the details of M. Dohrandt's experiments appeared objectionable, and as all the data necessary for determining the constants were not given, it seemed desirable to repeat them.

After describing the apparatus used, and the locality where it was erected, he explains the forces which act on an anemometer. When these balance each other through a revolution, the condition of permanent motion is expressed by the equation $\alpha V^2 - 2\beta Vv - \gamma v^2 - F = 0$. Where V and v are the velocities of the wind and anemometer in miles per hour, F the momentum of the friction, at the centres of the cups, in grains, the coefficients α, β, γ, cannot be found *à priori* in the present state of hydrodynamics; but if they be constant, or vary but little as v changes, they can be found, at least approximately, by combining several equations in which $V v F$ are known. Unfortunately this method has serious difficulties. We cannot produce wind of a known V, and must substitute for it the transport of the anemometer through the air at a known speed. But the rotation of the whirling machine produces an air vortex of considerable power, whose motion must be subtracted from that of the machine. If this motion were uniform it would do no harm, but it is found to be so very irregular that the V which must be used is uncertain.

The determination of F was also uncertain in these experiments, chiefly because the locality where the apparatus was erected (though the best which he could obtain) was affected by tremors by the action of adjacent machinery which made the frictions variable. Five anemometers were tried. No. 1 with 9-inch cups and 24-inch arms, the Kew type; No. 2, the same arms, but 4-inch cups; No. 3, with 9-inch cups and 12-inch arms; No. 4, the same 12-inch arms and 4-inch cups; and No. 5, semi-cylinder cups 9 inches square and 24-inch arms. Of these the small cups gave unsatisfactory results, the cylinders (to his surprise) the best; the 9-inch were sufficiently good to authorise the following conclusions, observing that α was measured directly. It is as the area of the cups, and is independent of the length of the arms, unless they are so short that the wake of one cup interferes with the followers.

1. The equation represents the observations well enough for all practical purposes, while V ranges from 5 to 40, and F from 113 to 3683.

2. It is equally effective if γ be omitted.

3. β and γ are probably proportional to α, and the three are as the density of the air.

4. Admitting this, the specialty of any anemometer depends on $\frac{F}{\alpha}$ only.

5. The ratio of the wind's velocity to that of cups changes with v and F. The highest value in these experiments = 21·58; its least value = 2·32.

6. With the constants which he found for the 9-inch cups, the limit of this ratio, that for V infinite = 2·30 instead of 3·0.

He proposes to verify these conclusions with real wind, and has established No. 1 near one of the Kew type similar to it. By comparing their simultaneous v under different frictions, he will obtain equations which, assuming α as known, will, he hopes, give β and γ far more certainly.

Mathematical Society, May 9.—Lord Rayleigh, F.R.S., president, in the chair.—Messrs. Wm. Hicks and T. R. Terry were elected members, and Prof. Minchin was admitted into the Society. Messrs. Brioschi, Darboux, Gordan, Sophus Lie, and Mannheim, were elected honorary foreign members.—Prof. Henrici, F.R.S., communicated a paper by Dr. Klein, of Munich, "Ueber die Transformation der elliptischen Functionen."—Prof. Cayley, F.R.S., spoke on the theory of groups.—Prof. Kennedy read his notes on the solution of statical problems connected with linkworks and other plane mechanisms. The special object of this last paper was to give an elementary solution of the problem: given a linkwork or plane mechanism of any number of links, with any force acting on any one of them, find the magnitude of the force necessary to balance the mechanism of acting in any direction on any other link. The method employed was the replacement of the two links on which the forces acted by two others which had the same instantaneous centres and the same angular-velocity ratio, but which were so chosen that they could be directly connected together by a third link. In this way a simple combination of the links was used as a "virtual mechanism" to replace the original complex linkwork, and the solution became extremely simple. Incidentally the author took occasion to insist on the advantages of the consistent use of the notion of the instantaneous centre even in the most elementary treatment of mechanical problems.—Mr. Glaisher, F.R.S., communicated a generalised form of certain series.—Mr. Kempe read a portion of his paper on conjugate four-piece linkages.

Linnean Society, April 18.—Dr. J. Gwyn Jeffreys, F.R.S., vice-president, in the chair.—The Rev. H. H. Higgins exhibited photographs of a large beetle, the *Dynastes neptunus*, Shönherr, and of an undetermined species of locust from Borneo, the latter resembling the genus Pseudophyllus, but measuring 9½ inches in expanse of wings.—A paper on the geographical distribution of the gulls and terns (Laridæ) was read by Mr. Howard Saunders. Notwithstanding the wide marine dispersion of the group, it possesses several remarkable isolated forms. In numbers there are about fifty-three species of terns and skinners, fifty of gulls, and six of Skua gulls. The majority of the typical Laridæ are found in the North Pacific, where alone the Arctic and white primaried forms are connected through *Larus glaucescens* with the group which have distinctly barred primary wing feathers. In the same area can be traced the typical hooded gulls, of which *L. ridibundus* is the Palæarctic representative, and which in *L. glaucoides* reaches unbroken to the Magellan Straits, while in the eastern hemisphere it is not found beyond 10° N. lat. There also obtains the peculiar coloured tern, *Sterna aleutica*, which connects the typical Sternæ with the intertropical sooty-terns, *S. lunata*, *S. anæstheta*, and *S. fuliginosa*. Of isolated groups which have no apparent connection with the Pacific may be mentioned the New Zealand *Larus bulleri* and *L. scopulinus*, the Australian *L. novæ-hollandiæ* and the South African *L. hartlaubi*. In the Arctic region there are two isolated specialised genera of gulls, Pagophila and Rhodostethia, which are not known on the Pacific side, while amongst the terns the intertropical genera, Næmia, Anous, and Gygis, although somewhat related among themselves, offer no particular points of union with the typical Sterninæ. It results that the bulk of the evidence favours the idea of the North Pacific probably being the centre of dispersion of these chiefly oceanic or shore-frequenting birds, the Laridæ.—Mr. R. Irwyn Lynch next made a communication on the mechanism for the fertilisation of *Meyenia erecta*, Benth. This West African acanthaceous shrub has a funnel-shaped corolla with hairy anthers midway in the tube. The longer slender flexible style has its double-lipped stigma so formed and placed that insects alighting and entering towards the nectar at the bottom of the flower on their return, so move the lever-lip of the stigma as to produce pollenisation.—Mr. J. Clark Hawkshaw brought forward some notes on the action of limpets (*Patella*) in sinking pits in, and abrading the surface of the chalk at Dover. The limpet tracks are finely-grooved hollows generally of a zigzag pattern varying from eight to fourteen inches square, and about a line deep; and according to the author produced by the lingual teeth of the animal while grazing on the fine coating of sea-weed which covers the face of the chalk. The grooving deepens as the creatures repeat the process over the same ground; they moreover sink deeper stationary basin-shaped pits, resting-places to which they return after feeding. These latter, he holds, are also formed by mechanical, and not chemical agency, as some contend. Though taken singly, the denudation of the chalk by the limpets is very insignificant, yet taken in the aggregate, the amount annually abraded must be very considerable.—The following gentlemen were balloted for, and duly elected Fellows of the Society:—The Rev. A. A. Harland, the Rev. J. J. Muir, Mr. W. S. Piper, and Mr. Fred. Townsend.

Meteorological Society, April 17.—Mr. C. Greaves, president, in the chair.—Mons. Marié Davy, Capt. N. Hoffmeyer, Prof. D. Ragona, and Dr. A. Wojeikoff, were elected honorary members.—The discussion on waterspouts and globular lightning, which was adjourned from the last meeting, was resumed and concluded.—The following papers were then read:—On the application of harmonic analysis to the reduction of meteorological observations, and on the general methods of meteorology, by the Hon. R. Abercromby, F.M.S. The meaning of the harmonic analysis is first shown, in reference to average barometric pressure, by tracing the geometrical and physical significance of every step from the barogram till the tabulated results are combined in a harmonic series. It is then shown that, whether we regard this series simply as an algebraic embodiment of a fact, or as a series of harmonic components, as suggested by Sir W. Thomson, it is simply a method of averages, and our estimate of its value must depend upon an estimate of the use of averages at all in meteorology. It is then pointed out where averages are useful, and their failure to make meteorology an exact science is traced to three causes: (1) That the process of

averaging eliminates the variable effects of cyclones and anti-cyclones, on which all weather from day to day depends; and on this are based some general remarks on the use of synoptic charts, not only in explaining and forecasting weather, but in attacking such problems as the influence of changes of the distribution of land and water on climates, and the cyclic recurrence of rain or cold. (2) That deductions from averages only give the facts, and not the causes, of any periodic phenomena. The position of diurnal and other periodic variations in the general scheme of meteorology is then pointed out, and it is shown that their causes can only be discovered by careful study of meteorograms from day to day. (3) That in taking averages, phenomena are often classed as identical, which have really not one common property. For instance, rain in this country is associated with at least three different conditions of atmospheric disturbance, and it is necessary to discriminate between these kinds before meteorology can be an exact science.—On some peculiarities in the migration of birds in the autumn and winter of 1877-78, by J. Cordeaux.—Mr. Symons gave a verbal description of the recent heavy fall of rain, on April 10 and 11, the greatest amount known to have been registered being 4·6 inches at Haverstock Hill.

Royal Microscopical Society, April 3.—Mr. H. J. Slack, president, in the chair.—A paper was read by Mr. J. W. Stephenson on a new immersion object-glass which had been designed by him to obviate the difficulty often experienced in the accurate arrangement of the adjusting collars of high-angled objectives. This new glass had a focal distance of $\frac{1}{5}$ and a balsam angle of 113°; it was stated to bear very deep eye-pieces and to have a very flat field. The great difficulty of obtaining an "immersion" fluid having the same refractive index as crown glass had at length been overcome by the adoption of oil of cedar wood diluted with $\frac{1}{5}$ part of oil of fennel seeds. The objective was exhibited in the room at the close of the meeting.—A paper was read by Mr. Frank Crisp on the present condition of microscopy in England, in which, as regarded a knowledge of the optical and mathematical principles of the instrument, unfavourable comparisons were drawn between the workers at home and abroad, and a greater degree of attention to the construction of the various portions of the instrument was urged upon English microscopists.—After the meeting Dr. Millar exhibited a small piece of a very beautiful sponge, *Acarnus innominatus*, Gray, Mr. Curties some stained vegetable tissues, and Prof. Cleve some diatoms mounted to illustrate his pamphlet.

Geological Society, April 3.—Henry Clifton Sorby, F.R.S., president, in the chair.—Rev. Albert Augustus Harland, M.A., F.S.A., and Thomas William Shore, were elected Fellows of the Society.—The following communications were read:—On an unconformable break at the base of the Cambrian Rocks near Llanberis, by George Maw, F.L.S., F.G.S.—On the so-called greenstones of Central and Eastern Cornwall, by J. Arthur Phillips, F.G.S.—The recession of the falls of St. Anthony, by N. H. Winchell, communicated by J. Geikie, F.R.S., F.G.S.

PARIS

Academy of Sciences, May 6.—M. Fizeau in the chair.—The death of M. Malaguti, correspondent in chemistry, was commented on by M. Dumas.—The following among other papers were read:—Experiments on the heat which may have been developed by mechanical actions in rocks, especially clays; and deductions regarding metamorphism, &c. (continued), by M. Daubrée. He rotated rapidly a circular marble plate on a vertical axis, and applied to a small part of its surface, near the circumference, a small weighted and fixed marble plate, measuring the rise of temperature of the latter with an alcohol thermometer. In one minute, with 445 revolutions, there was an increase of 4·5°. Dry clay was also heated by friction on limestone, &c. Apart from all eruptive rocks, the transformation of rocks and appearance of new mineral species may be caused by mechanical actions in the rocks transformed.—On a new memoir by M. Bertin. Observations on rolling and pitching with the double oscillograph, on board various ships, by M. Dupuy de Lome. *Inter alia*, it is shown that the duration of rolls varies a little (for the same vessel) with the intensity of the wind, and (contrary to what one might at first think) the rolls executed against the wind are always considerably shorter than those in the opposite direction.—M. Chauveau was elected correspondent in medicine and surgery, in room of the late M. Gintrac.—Researches proving the non-necessity of intercrossing of the conductors serving for voluntary movements at the base of the brain, or elsewhere, by M. Brown-Sequard. Two series of arguments are adduced to prove that these conductors do not intercross in the rachidian bulb nor in the protuberance; hence the inference stated.—On the mechanism and use of a differential counter, by M. Valessie. This instrument gives precise indications for regulating the average velocity and working of a machine; it is used in several French ironclads. Its principal part is a second watch, the case of which turns, by the action of the engine, in the opposite direction to that of the needle.—On the impossibility of propagation of persistent longitudinal waves in ether, free or engaged, in a transparent body, by M. Pellat. This demonstration is based (1) on the fact that the reflection at the surface of an isotropous transparent body, under Brewsterian incidence, extinguishes almost completely a ray polarised in the perpendicular plane; (2) on the principle of conservation of energy applied to such reflection, supposing it takes place according to Cauchy's formulæ.—On the telegraphic employment of the telephone, by M. Gressier. He distinguishes two kinds of disturbing sounds—that arising from induction by currents in neighbouring wires, and a very confused noise (heard most at night and accompanied with deflection of the galvanometer), which he thinks due to the wire passing in different places through air layers which undergo rapid and considerable variations in potential, producing various currents. This suggested a means of studying variations in atmospheric electricity. M. Du Moncel pointed out that these latter currents had been studied with the galvanometer.—On the crystallisation of silica by the dry process, by M. Hautefeuille. Alkaline tungstates may with advantage be used instead of phosphates (as used by M. Rose), for they render obtainable at will, crystallised silica, either in the tridimite or quartz form.—On the gold method and the termination of the nerves in unstriated muscle, by M. Ranvier. As in striated muscle, these nerves end with an arborised expansion of the cylinder axis on the surface of the muscle-elements. In contraction an organ co-operates which is not under the direct action of the nerve-centres.—Action of morphine on dogs, by M. Picard. The vascular dilatation and contraction of the pupil result from paresis of the sympathetic nerve.—On Wartelia, a new genus of annelids considered wrongly as embryos of Terebella, by M. Giard.—On the malacological fauna of New Guinea, by M. Tapparone-Canefoi. This belongs quite to the great fauna of the Indo-Pacific region.—Soda in plants, by M. Contejean. More than three-fourths of terrestrial plants (not maritime) belonging to regions not apparently saline contain soda; it is mostly in the subterranean portion. Aquatic plants have it in all their submerged parts. The aptitude for soda varies according to family, species, &c.

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